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Data Structures

Collections Framework

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Collection Framework

- Framework of built-in data structures
- Provides consistent interaction with all collections
- Provides efficient implementations
- Provides common algorithms (e.g. search, sort)
- Size is flexible, collections may grow/shrink in size

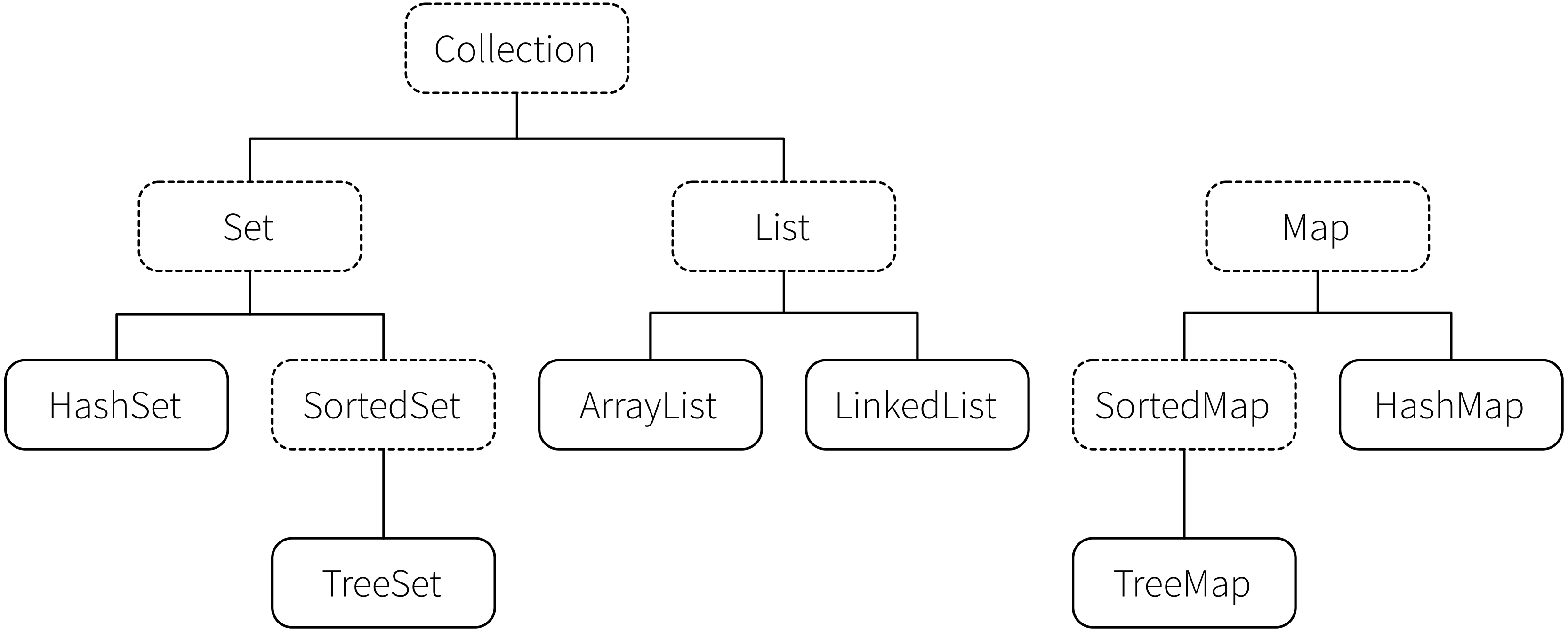
http://docs.oracle.com/javase/8/docs/technotes/guides/collections/index.html

Collection Framework

- A collection must contain elements of the same type*
- Requires objects, does not work with primitive types
  - Use Integer instead of int, etc.
  - Collections are objects, allows nesting
- Specify element type using Generics syntax
  - e.g. HashSet<String>
  - e.g. HashMap<Integer, String>

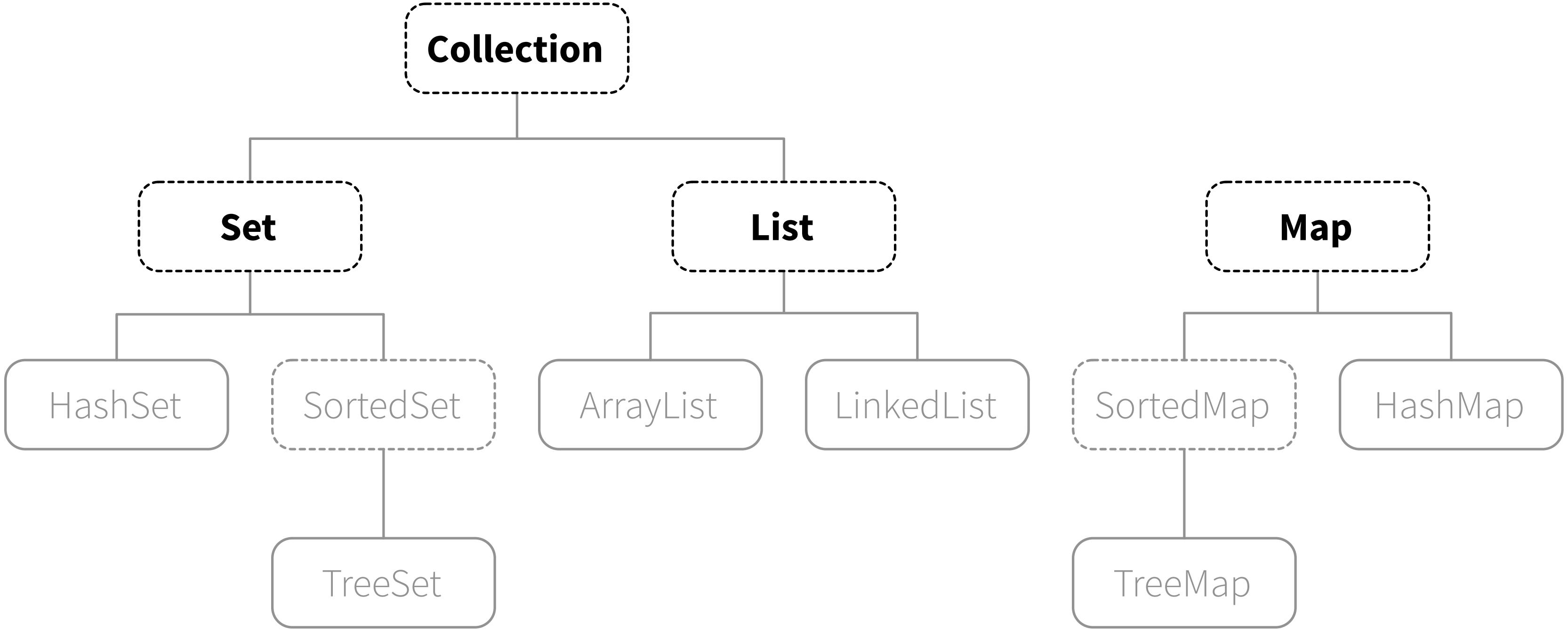
http://docs.oracle.com/javase/tutorial/extra/generics/

Collection Framework*



*Abbreviated Framework

Collection Framework*



*Core Interfaces

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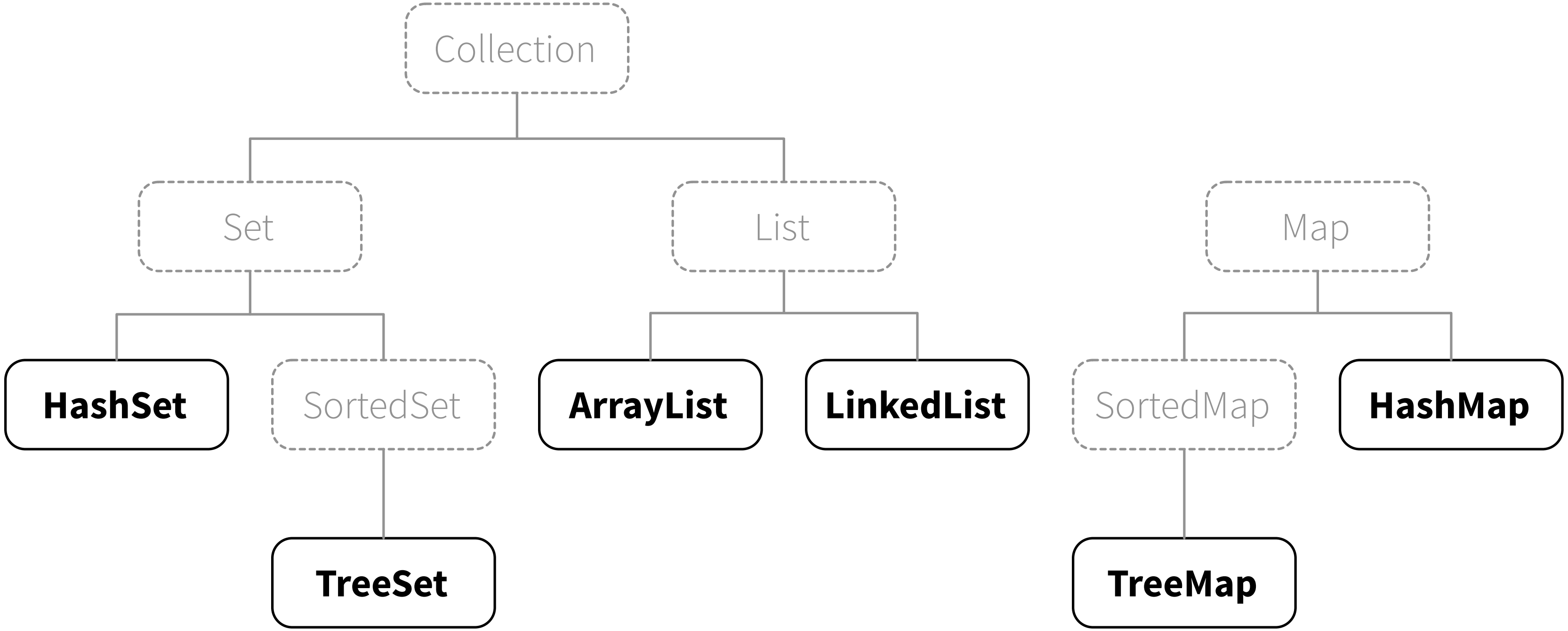
Collection Framework*



*Core Implementations

Collection » List » ArrayList

- Iteration is in insertion order
- Operations add(E e), get() and set() are constant time* (i.e. fast)
- Operations add(int i, E e), remove(), and contains() are linear time (i.e. slow)
- Good default implementation

http://docs.oracle.com/javase/8/docs/api/java/util/ArrayList.html

Collection » List » LinkedList

- Iteration is in insertion order
- Double-linked list, so operations adding/removing to front or back is constant time (i.e. fast)
- Operations that require an index (like getting or removing at an index) are linear time (i.e. slow)
- Choose if need to insert/remove elements at front

http://docs.oracle.com/javase/8/docs/api/java/util/LinkedList.html

Collection » Set » HashSet

- Iteration is in unsorted order
  - Iteration order is not guaranteed
  - Iteration order may change over time
- Operations add(), remove(), and contains() are constant time (i.e. fast)
- Good default implementation

http://docs.oracle.com/javase/8/docs/api/java/util/HashSet.html

Set » SortedSet » TreeSet

- Iteration is in sorted order
  - Iteration order may change over time
  - Can quickly navigate forward and backward
- Operations add(), remove(), and contains() are log(n) time (i.e. decent)
- Only choose if need to maintain sorted order

http://docs.oracle.com/javase/8/docs/api/java/util/TreeSet.html

Map

- Must specify key type and value type
  - e.g. HashMap<Integer, String>
- Keys must be unique and immutable
  - String may be a key
  - ArrayList may *not* be a key
- Values may have duplicates and may change
  - String and ArrayList may be values

Map » HashMap

- Iteration of keys is in unsorted order
  - Iteration order is not guaranteed
  - Iteration order may change over time
- Operations get() and put() are constant time (i.e. fast)
- Good default implementation

http://docs.oracle.com/javase/8/docs/api/java/util/HashMap.html

Map » SortedMap » TreeMap

- Iteration of keys is in sorted order
  - Iteration order may change over time
  - Can quickly navigate forward and backward
- Operations get() and put() are log(n) time (i.e. decent)
- Only choose if need to maintain sorted order

http://docs.oracle.com/javase/8/docs/api/java/util/TreeMap.html

Collections Class

- Not to be confused with the Collection interface
- Utility class of static methods
  - Helper methods like addAll() and copy()
  - Common operations like binarySearch(), min(), max(), frequency(), reverse(), sort(), shuffle(), swap()

http://docs.oracle.com/javase/8/docs/api/java/util/Collections.html

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